MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

ECE2056 – DATA COMMUNICATIONS AND NETWORKING

(All sections)

6 JUNE 2018
9.00 A.M. – 11.00 A.M.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This examination paper consists of 6 pages with 4 questions only.

2. Answer **ALL** the 4 questions. The distribution of marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

Question 1 (33 marks)

(a) Describe all the elements of a protocol.

[6 marks]

(b) Discuss the main protocols that work in the following Transmission Control Protocol/Internet Protocol (TCP/IP) layers.

(i) Transport layer

(ii) Network Layer

[4+2 marks]

(c) Discuss ONE advantange of the following switching methods.

(i) Packet Switching

(ii) Circuit switching

[1.5+1.5 marks]

(d) Citing suitable examples, discuss the types of addresses defined by link layer protocols.

[6 marks]

(e) The Point-to-Point (PPP) protocol is a widely used protocol that resides in the Data Link Control (DLC) sublayer.

(i) With the aid of a diagram, describe the phases of the PPP protocol.

(ii) State the protocols that reside within the PPP protocol, and briefly discuss the functions of these protcols.

[6+6 marks]

Continued...

Question 2 (22 marks)

(a) A pure ALOHA network transmits 100-bit frames on a shared channel of 200 kbps.

(i) What is the throughput if the system (all stations together) produces 2000 frames per second? [2 marks]

(ii) Determine the number of frames per second produced by the system (all stations together) that can achieve the maximum throughput for the pure ALOHA network. [2 marks]

(iii) If the slotted ALOHA is used to replace the pure ALOHA for the network, determine the number of frames per second produced by the system (all stations together) that can achieve the maximum throughput. [2 marks]

(iv) Explain why the slotted ALOHA is able to double the maximum throughput compared to the pure ALOHA. [2 marks]

(b) Briefly describe how the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) algorithm reduces the channel wastage in the CSMA algorithm when collision occurs. [3 marks]

(c) With the assistance of diagrams, describe the time-division multiple access (TDMA) and the frequency-division multiple access (FDMA) protocols. [6 marks]

(d) In a 10base5 network, the propagation delay between stations A and B is 250 bit time and the minimum frame size is 500 bits. Each station must sense that the channel is idle for 64 bit times before transmitting any frame. Suppose stations A and B send frame at $t = 0$s.

(i) Determine the time of the collision and the time that both stations detect the collision. [2 marks]

(ii) When the collision is detected, each station sends a 24-bit jam signal with station A draws $K = 0$ and B draws $K = 1$ (multiples of 500 bit times) from exponential back-off algorithm. Find the time for the first bit of station A's frame to reach station B.

Note: K is a a random number of slot times. [3 marks]

Continued...

Question 3 (22 marks)

(a) The Internet Protocol (IP) is an important network layer protocol that enables host-to-host delivery and routing.

(i) Is IP a reliable or unreliable protocol? Justify your answer.

[2 marks]

(ii) Is IP a connection-oriented or connectionless protocol? Justify your answer.

[2 marks]

(iii) How many bits are there in a IPv4 address?

[1 mark]

(iv) IPv6 is the successor of IPv4. How many bits are used in IPv6 addressing?

[1 mark]

(b) A classless address is given as 167.178.171.83/25

(i) Determine the number of host addresses available in the network.

[1 mark]

(ii) What is the first address in the network?

[3 marks]

(iii) What is the last address in the network?

[3 marks]

(c) A company is assigned the IP address of 10.0.10.0/30. Design an IP addressing scheme with subnetting that can accommodate 5 subnets with 12 usable hots in each subnet.

(i) What is the number of bits that must be borrowed from the Host ID in order to accommodate the 5 subnets?

[1 mark]

(ii) What is the number of bits that must be reserved to accommodate 20 hosts?

[1 mark]

(iii) Determine the subnet mask.

[2 marks]

(iv) List the network address for each of the 5 subnets.

[5 marks]

Continued...

Question 4 (23 marks)

(a) The User Datagram Protocol (UDP) uses a very simple checksum mechanism based on one's complement. Suppose the following 16-bit data words X = 1011 0100 0100 1101 and Y = 0001 1001 0111 1011 have been received, followed by the UDP one's complement checksum Z = 1100 1101 1101 1000. Discuss whether there is any error and if so, whether this error can be detected.

[6 marks]

(b) **Figure Q4(b)** below illustrates the UDP packet format notably its header fields. Supposing that the data field takes up 4 bytes, what is the value stored in the 16-bit UDP length field? Show your steps / calculations.

[6 marks]

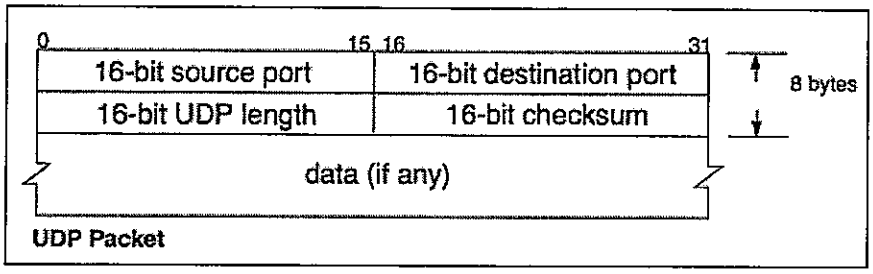

Figure Q4(b): UDP Packet format

Continued...

Question 4 (cont) (23 marks)

(c) **Figure Q4(c)** below illustrates the main idea behind the difference between the transport layer and network layer protocols. With reference to this, describe your understanding of what are the main *differences* are between the two layers.

[5 marks]

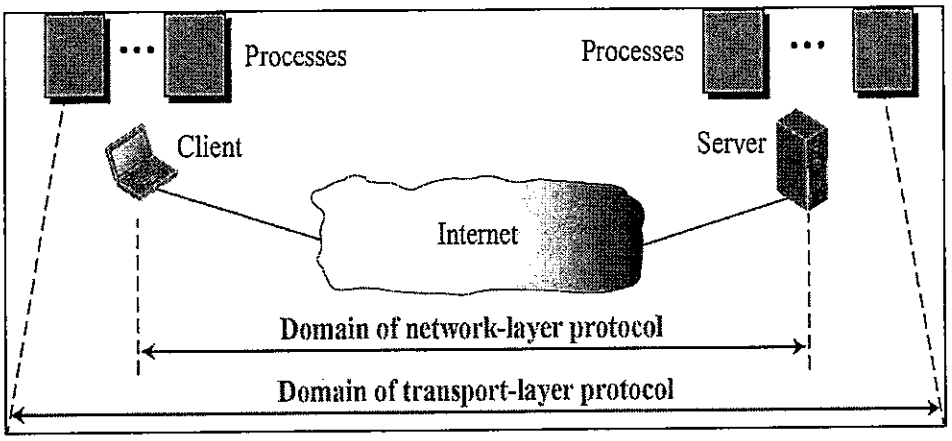

Figure Q4(c): Transport layer vs Network layer protocols

(d) **Figure Q4(d)** illustrates an example scenario within a TCP connection. With reference to this, discuss the sequence flow and analyze how ACK(acknowledgement) is used by TCP for error control.

[6 marks]

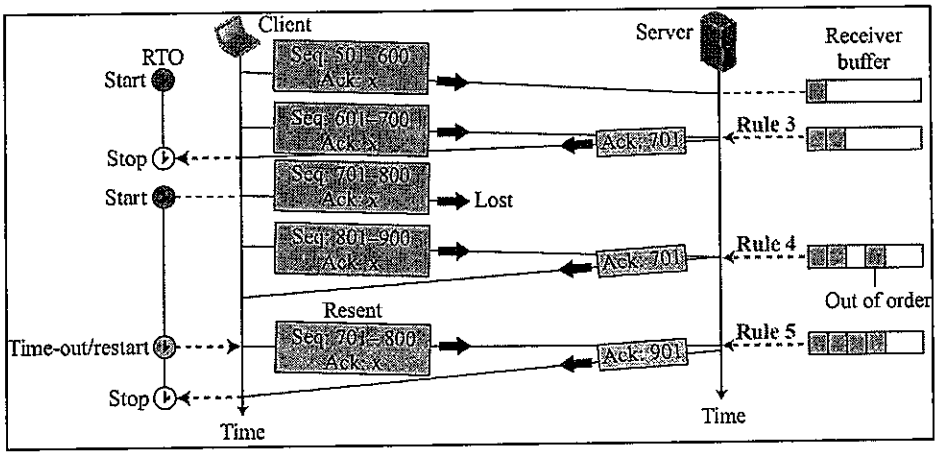

Figure Q4(d): TCP Error Control scenario

End of paper